PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-066115

(43)Date of publication of application : 08.03.1994

(51)Int.Cl. F01L 1/34
F04C 2/10
H02K 19/10

(21)Application number : 05-065080

(22)Date of filing : 24.03.1993

(71)Applicant : ROBERT BOSCH GMBH

(72)Inventor : KAEHLER STEFFEN
KRAMER KLAUS
REMBOLD HELMUT

(30)Priority

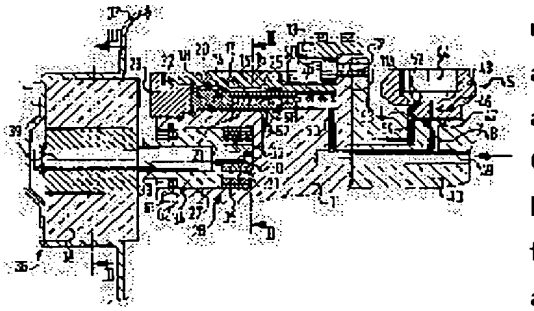
Priority number : 92 4209792 Priority date : 26.03.1992 Priority country : DE

(54) HYDRAULIC MACHINE TYPE CONTROL DEVICE

(57)Abstract:

PURPOSE: To simplify the structure of a hydraulic machine type control device for driving a camshaft and rotating the camshaft relatively with respect to a sprocket driven by a crankshaft, and to easily mount the device on an internal combustion engine.

CONSTITUTION: A camshaft 10 has a partially hollow cylindrical connecting member 14 formed as a ring, which is slidably arranged in an intermediate annular chamber 15 between a central body 11 and a protrusion 16 of a sprocket 13 coupled together by a screw 12. The connecting member is arranged on the central body, and moved against a compression spring 26 by the engine oil discharged from an internal gear pump 28 arranged in a cylindrical recess coaxial with the camshaft. At that time, helical teeth 18 and 20 of



the connecting member engage a helical tooth 19 on the internal surface of the protrusion and a helical tooth 21 at the outer side of the central body respectively, thereby causing the sprocket and the camshaft to rotate relatively with respect to each other. The internal gear pump is driven by an electric reluctance motor 36.

LEGAL STATUS

[Date of request for examination]	23.03.2000
[Date of sending the examiner's decision of rejection]	03.04.2003
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	2003-12383
[Date of requesting appeal against examiner's decision of rejection]	02.07.2003
[Date of extinction of right]	

[Claim(s)]

[Claim 1] It is a hydraulic machinery-type control unit for rotating an internal combustion engine's cam shaft (10) relatively to the drive pulley (13) of this cam shaft. The bell shape connection member (14) by which the pressure load was carried out is prepared, and this connection member is guided between said drive pulleys and centrosomes (11). The peripheral face of said connection member has ****** (18), and this ****** (18) was prepared in the inner skin of said drive pulley. It has geared with corresponding ****** (19). Inside said connection member (14) ****** (20) is arranged and this ****** (20) was prepared in the peripheral face of said centrosome (11). Have geared with corresponding ****** (21) and relative rotation with a drive pulley and a cam shaft is made to be generated by migration of said connection member. In the thing of the format which the pump (28) is arranged at said centrosome and carries out the regurgitation of the pressure medium required for migration of this pump of said connection member Hydraulic machinery-type control unit characterized by said pump (28) driving with the reluctance motor (36).

[Claim 2] The control unit according to claim 1 said whose pump (28) is an internal gear pump.

[Claim 3] The control unit according to claim 2 said whose internal gear pump is G mold Rota pump.

[Claim 4] A control unit given [to claims 1-3 by which pumping pressure required for migration accommodation or positioning is adjusted by control of the rotational frequency of said pump] in any 1 term.

[Claim 5] The control unit given [to claims 1-4] in any 1 term with which said reluctance motor is arranged in the exterior of said centrosome in casing (37) which encloses a control unit.

[Claim 6] The control unit given [to claims 1-5] in any 1 term which the reservoir (44) of a pressure medium is formed in the bearing (45) which consists of two parts for said cam shaft, and this reservoir extracted, and has been connected to an engine-oil reservoir through a hole (46).

[Claim 7] In the hydraulic machinery-type control unit for rotating an internal combustion engine's cam shaft relatively to the drive pulley of this cam shaft by the connection member Said connection member is the work cylinder (65) of a double acting type, and both the pressure room (68 69) of this work cylinder is controlled by the control valve (70) of an automatic actuation type. The valve needle (71) of this control valve is controlling two valve seats (72 73) which are in the opposite side mutually. Hydraulic machinery-type control unit which the pressure-medium connection (76 77) is prolonged in said both pressure room of said work cylinder, and is characterized by a valve element resisting the force of adjusting spring (86) with the

pressure of the pump (84) by which revolving speed control is carried out and being movable from these both valve seats.

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention is a hydraulic machinery-type control unit for rotating an internal combustion engine's cam shaft relatively to the drive pulley of this cam shaft. The bell shape connection member by which the pressure load was carried out is prepared, and this connection member is guided between said drive pulleys and centrosomes. The peripheral face of said connection member has ******, and this ****** was prepared in the inner skin of said drive pulley. Have geared with corresponding ****** and ****** is arranged inside said connection member. This ****** has geared with corresponding ****** prepared in the peripheral face of said centrosome. Relative rotation with a drive pulley and a cam shaft is made to be generated by migration of said connection member, the pump is arranged at said centrosome, and it is related with the thing of the format which carries out the regurgitation of the pressure medium required for migration of this pump of said connection member.

[0002]

[Description of the Prior Art] The pump is arranged outside and a solenoid valve is still more nearly required of especially the well-known control unit of such a format. thereby -- this equipment -- especially -- a conduit -- even if it sees from the point that connection is needed, it becomes structural comparatively complicated, and cost cuts in many (the Federal Republic of Germany patent public presentation No. 3247116 specification).

[0003]

[Problem(s) to be Solved by the Invention] The technical problem of this invention is offering a control unit which improves the control unit of the format stated at the beginning, has very simple structure, and is simply attached to an internal combustion engine.

[0004]

[Means for Solving the Problem] In order to solve this technical problem, it was made for the pump to drive with the reluctance motor with the configuration of this invention.

[0005]

[Effect of the Invention] According to this invention, a control unit is very compact, and is constituted simply, as a result can be attached in the engine interior of a room of an internal combustion engine or an internal combustion engine satisfactory. Another advantage of this invention is acquired [two or less-claim] from the means

of a publication.

[0006]

[Example] Below, two examples of this invention are explained in detail per drawing.

[0007] An internal combustion engine's cam shaft is shown by the sign 10 in the example shown in drawing 1 . This cam shaft is ****ed, it is firmly combined with centrosome 11 by 12, and this centrosome is further combined with the sprocket 13. This sprocket is driven with an internal combustion engine's crankshaft. This shows these parts rotating and rotating the connection member 14 14, i.e., the connection member which was partially formed as a bell shape ring and has been arranged possible [a slide in the middle room 15 between centrosome 11 and the lobe 16 of a sprocket], similarly. As for the edge of said connection member of the opposite side, that outside has **** 18, and this ****** 18 has geared with the cam shaft with ****** 19 prepared like the inside of a lobe. Also inside the connection member has ****** 20 and that of the outside where this ****** 20 was formed in centrosome 11 has geared with **** 21. With the cam shaft, the pressure room 22 is formed in the edge of said connection member of the opposite side, this pressure room is closed by the annular covering 23, and this covering is screwed in the free edge of centrosome. Relative rotation with a sprocket 13 and a cam shaft 10 is made to produce the above by migration of the shaft orientations of the connection member 14 by ****.

[0008] This connection member has the bell shape annular room 25, and compression spring 26 is arranged at this annular room. This compression spring is supported by the pars basilaris ossis occipitalis of the annular room 25, and, on the other hand, is supported by extension 11A of the shape of a flange of centrosome 11.

[0009] Centrosome has the notch 27 of the shape of a cylinder prolonged in same axle to this cam shaft in the opposite side in the cam shaft 10, and the internal gear pump 28, especially G mold Rota pump are arranged at this notch. Especially by drawing 2 , this internal gear pump is equipped with the inner rotor 30 and the outer rotor 31 eccentrically located in centrosome 11 so that clearly. The minor axis 32 formed in the shaft 33 is equipped with the inner rotor at relative rotation impossible. Furthermore, bearing of this shaft is carried out to the bearing bush 34 arranged at the notch 27. It rotates within the spacer sleeve 35 arranged too at the notch 27, and the width of face of this spacer sleeve of an outer rotor 31 is larger than both gearings' width of face a little in this case. A shaft 33 and an internal gear pump 28 are driven with the electromotive reluctance motor 36. This reluctance motor is arranged in the sheet metal casing 37 (only the part was illustrated), and this sheet metal casing has held the control unit in the interior. This reluctance motor has a stator 38 and Rota 39 in the well-known format. Drawing 3 is the sectional view of a reluctance motor, and this reluctance motor understands that the coil 40 and the magnetic pole segment 41

other than a stator 38 and Rota 39 are prepared for it.

[0010] Especially for pressure-medium supply, a reservoir 44 is useful, and this reservoir is formed in the bearing shell 43 of the bearing 45 top for said cam shafts which consists of two parts. In addition, only the Johan section is illustrating the bearing for cam shafts. From the reservoir, the diaphragm hole 46 leads to the circular sulcus 47 established in the cam shaft 10, and the location to the longitudinal direction hole 48 leads to the longitudinal direction path 49 prepared in the cam shaft. An engine oil is supplied to this longitudinal direction path. This longitudinal direction path 49 has rushed even into centrosome 11, and has extended from this location in the annular room 25 where the longitudinal direction hole 50 was formed between centrosome 11 and a sprocket 13. From the reservoir 44, the inclination hole 52 leads to the circular sulcus 53 between a cam shaft and the bearing for said upper cam shafts further. The crooked path 54 (only the part was illustrated) leads to the inlet port 55 of an internal gear pump 28 from this circular sulcus 53 (refer to drawing 2). The crooked path 57 leads to the circular sulcus 58 established in the annular room 15 from the delivery 26 of an internal gear pump. Furthermore, this circular sulcus 58 is connected to the pressure room 22 through ******. Since the seal of the part in front of the connection member 14 is carried out to the lobe 16 of a sprocket, and centrosome with packing 60, a pressurization medium cannot advance into a spring room.

[0011] The bearing bush 34 is pressed by the spacer sleeve 35 by the snap ring 61 and the disk spring 62, and has covered the free end of an internal gear pump.

[0012] If an internal gear pump 28 does not form a pressure, compression spring 26 will be moved until it contacts covering 23 toward the left in the connection member 14. Furthermore, a sprocket 13 takes the predetermined angular position to a cam shaft 10 by ****** (closing with a later intake valve). The outflow of the pressure medium from the pressure room 22 is performed through the leakage gap prepared in the gear pump, or is performed by the inversion of the hand of cut of a reluctance motor 36.

[0013] When changing the angular position, an internal gear pump must form the proper pressure relevant to the rotational frequency of a reluctance motor 36. With an internal gear pump, a for the first time comparatively big pressure can be formed by rotational frequency >3000rpm. As already stated, the longitudinal direction path 49 and the longitudinal direction hole 50 for intake lead to the reservoir 44, and an engine oil is supplied to this reservoir through a path 48 from an engine-oil circuit with the diaphragm hole 46. If a pressure rises, through a path 57, it will be pushed away by the supplied pressure medium in a circular sulcus 58, and it will reach in the pressure room 22 through ****** 18-21. The connection member 14 resists the force of

compression spring 26, and moves toward a cam shaft. Whenever [angular relation / of a cam shaft 10 and a sprocket 13] changes with ****** towards early closing of an engine intake valve. For example, at the proper rotational frequency of said reluctance motor 36 adjusted through an electronic control, the angular position of relative arbitration with both [these] parts, i.e., a cam shaft, and a sprocket can be adjusted within the limits of predetermined.

[0014] the lilac KUTANTSU motor 36 — quantity — it is very well suitable for dynamic operation. The rotational frequency of a reluctance electric motor is reduced and, thereby, carries out power consumption mist beam reduction as a cam shaft rotational frequency increases. The motor rotational frequency is controlled so that the passing speed or the location of a request of a connection member is obtained each time. Thereby, it becomes certain that the fluctuation range of the oil charge of an internal gear pump becomes unrelated almost equal to the rotational frequency of a cam shaft. The characteristic curve of a pump is shown in the diagram of drawing 4 . A reluctance motor rotational frequency is taken by the axis of abscissa shown in this diagram, and the volume efficiency of a pump is taken by the axis of ordinate, respectively. Here, two pressure curves P1 and P2, i.e., two pressure curves which are P2>P1 in this case, are shown in relation to the rotational frequency.

[0015] The example shown in drawing 5 differs from the above-mentioned example remarkably. In this example, the accommodation cylinder 65 equipped with the piston 66 and the piston rod 67 is formed, it is equivalent to the connection member 14 indicated to be these pistons and piston rods to drawing 1 , and an accommodation cylinder performs justification with a sprocket and a cam shaft. In a piston, a batch gets down from two pressure rooms 68 and 69, and the control valve 70 equipped with the valve needle 71 is useful for control of a cylinder 65. This valve needle collaborates with the 1st valve seat 72 and the 2nd valve seat 73 of the opposite side. The 1st valve seat 72 is located in ** 74, and the 2nd valve seat 73 is located in ** 75 of the opposite side. Both these ** are mutually divided by the valve needle 71. The conduit 76 leads to the pressure room 68 from ** 74, and the conduit 77 leads to the pressure room 69 from ** 75. the foramen cecum ossis forntalis 79 of the center to which a valve needle extends in that direction of a longitudinal axis — having — **** — those near both ends from this foramen cecum ossis forntalis — two longitudinal direction holes 80 and 81 — the exterior — going — extending — **** — each — opening is carried out to a room 74 or ** 75. the foramen cecum ossis forntalis 79 — a solid sphere — 82 is closed down densely. The conduit 83 is connected to ** 75 and this conduit leads to the pump 84. This pump is too driven with an electric motor 85. The pump 84 is connected to the source of an engine oil.

[0016] The valve needle 71 is pressed by the valve seat 73 with compression spring

86, when the pressure has not arisen yet. Where a valve seat 73 is closed according to the pressure which was formed with the pump 84 and which can be adjusted within ** 75, a piston 66 moves toward the left. This means a later valve block stage. The medium which flowed out of the pressure room 68 at that time flows on a tank without pressure through the open valve seat 72 and the return way 87. If the pressure beyond the open pressure discharge in a valve seat 73 arises, the valve needle 78 will resist the spring force of compression spring 86, will move toward the left, and will carry out the seal of the valve seat 72. At this time, the load of the pressure is carried out to a comparatively big area by the valve seat 73, and that only the circumferentia is effective can attain a positive change-over by the valve seat 72 to it and coincidence. Since it is set up so that a pressure with the hole always equal to both ** 74 and 75 at right and left prepared in the valve needle may arise, dust is not stuffed into the guide gap of a valve needle. Thus, since direct continuation of both the pressure rooms 68 and 69 is carried out to equal pressure level, a piston 66 moves in the direction of "being early" toward the right. A dimension setup of the pressure receiving surface ratio must be carried out so that the pressure level for the maintenance location in the mid-position may become higher than open pressure discharge of a valve seat 73.

[0017] If the example shown in drawing 1 is described additionally, using the coupling device which can be adjusted instead of the reluctance electric motor 36 will also be considered. However, a pump must be designed comparatively greatly in this case. It is the cam shaft rotational frequency of 500rpm., and it is because a required pressure and charge must already be prepared. Advantageously, the sensor for detecting the Rota location may be excluded. If Rota rotates, the location is computable also from change of a stator current.

[Brief Description of the Drawings]

[Drawing 1] It is drawing of longitudinal section having shown some hydraulic machinery-type control units by this invention.

[Drawing 2] It is the sectional view shown along with the II-II line of drawing 1 .

[Drawing 3] It is the sectional view shown along with the III-III line of drawing 1 .

[Drawing 4] It is the diagram having shown the characteristic ray of a pump.

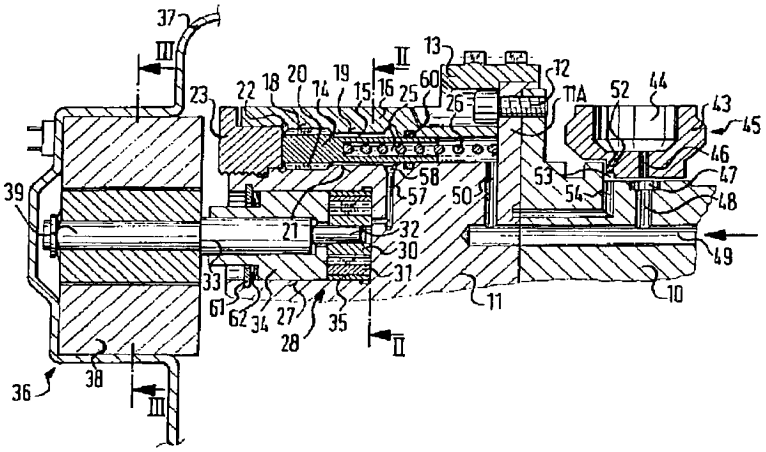
[Drawing 5] It is the schematic diagram having shown partially another example of the hydraulic machinery-type control unit by this invention.

[Description of Notations]

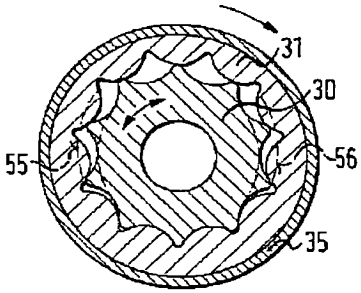
10 Cam Shaft 11 Centrosome 11A Extension 12 It ****s. 13 sprocket 14 Connection member 15 Annular room, 16 Lobe 18, 19, 20, 21 **** 22 Pressure room, 23 Covering 25 Annular room 26 Compression spring, 27 Notch 28 Internal gear pump 30 Inner rotor, 31 Outer rotor 32 Minor axis 33 Shaft 34 Bearing bush, 35 Spacer sleeve 36

Reluctance motor, 37 Sheet metal casing 38 Stator 39 Rota, 40 Coil 41 Magnetic pole segment 43 Bearing shell, 44 Reservoir 45 Bearing 36 Diaphragm hole, 47 Circular sulcus 48 Longitudinal direction hole 49 Longitudinal direction path, 50 Longitudinal direction hole 52 Inclination hole 53 Circular sulcus, 54 A path, 55 Inlet port 56 Delivery 57 Path, 58 Circular sulcus 60 Packing 61 Snap ring, 62 Disk spring 65 Accommodation cylinder 66 Piston, 67 Piston rod 68 69 Pressure room 70 Control valve, 71 valve needle 72 73 Valve seat 74 75 Room, 76 77 A conduit, 79 Foramen cecum ossis forntalis 80 81 Longitudinal direction hole 82 Solid sphere 83 Conduit 84 pumps 85 Electric motor 86 compression spring 87 Return way

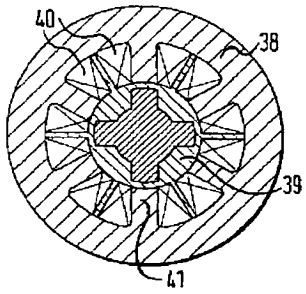
[Drawing 1]



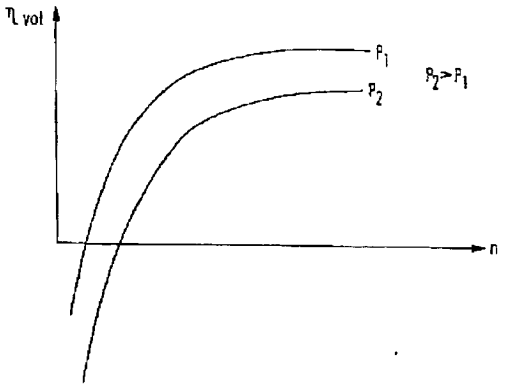
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Drawing 5]